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REMARKS

Claim Amendment

Claims 3 and 8 have been amended to correct the typographical error of "the around" to --around--.

Claim 5 has been amended to correct the typographical errors of "relow" to --reflow--.

Claims 3-5 have been amended to correct errors due to lack of proper antecedent bases:

1. The "the" before "integrated circuit package" has been corrected to --an--.
2. The "the" before "printed circuit board" has been corrected to --a--.

Claim 11 has been amended to correct the typographical error of "gasto" to --gas to--.

Claim Rejections - 35 USC §102

Claims 1-3, 5-8 and 10 are rejected under 35 U.S.C. §102(b) as being anticipated by Schmatz et al. (US 5,096,110, hereinafter "Schmatz").

Schmatz discloses a control system and method of vacuum brazing of aluminum workpieces in a vacuum chamber wherein the combination of the partial pressure of water and the partial pressure of oxygen is adjusted to be within a determined desired combination pressure range as a function of the temperature within the chamber as the workpieces are heated up to a temperature of about 500°C.

Regarding independent claims 1 and 6, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified in claim 1, includes the limitations not disclosed in Schmatz of:

"replacing air around an unsoldered part with a first inert gas;
removing the first inert gas to form a vacuum around the unsoldered part;
vacuum reflow soldering the unsoldered part to form a reflow-soldered part;
providing a second inert gas to fill the vacuum around the reflow-soldered part;
and
replacing the second inert gas with air around the reflow-soldered part."

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The Examiner states in the Office Action of April 12, 2005 (hereinafter the "Office Action"):

"Schmatz teaches a system for soldering a part comprising a means for replacing air around an unsoldered part with inert gas, means for replacing the gas with vacuum and means for backfilling the vacuum with gas and air which can be used for cooling. The gases are presumably the same (figure 1 and col 3 line 43 - col 4 line 8)."

Applicants respectfully disagree. It is respectfully submitted that Schmatz FIG. 1 and Schmatz col. 3, line 43, through col. 4, line 8, does not disclose using a vacuum or inert gas as claimed but instead discloses using a vacuum chamber to control the combination of partial pressures of oxygen and water while heating an object to brazing temperature:

"The system of the present invention further includes heating means, for controllably heating the workpieces within the vacuum chamber at a variable chosen heating rate, and pumping means for removing gases from the vacuum chamber.

...The processor means includes: ... (iv) adjustment means responsive to the control signal for adjusting the combination of the partial pressure of oxygen and the partial pressure of water in the chamber to correspond to an acceptable combination pressure as a function of the sensed temperature, comprising means for controlling the pumping means and the heating means. ..." [deletions and underlining for clarity]

Based on the above, it is respectfully submitted that claims 1 and 6 are allowable under 35 USC §102(e) as not being anticipated by Schmatz because:

"Anticipation requires the disclosure in a single prior art reference disclosure of each and every element of the claim under consideration." *W.L. Gore & Assocs. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983) (citing *Soundscriber Corp. v. United States*, 360 F.2d 954, 960, 148 USPQ 298, 301 (Ct. Cl.), *adopted*, 149 USPQ 640 (Ct. Cl. 1966)), *cert. denied*, 469 U.S. 851 (1984). *Carella v. Starlight Archery*, 804 F.2d 135, 138, 231 USPQ 644, 646 (Fed. Cir.), *modified on reh'g*, 1 USPQ 2d 1209 (Fed. Cir. 1986); *RCA Corp. v. Applied Digital Data Sys., Inc.*, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984).

Regarding claims 2-3 and 5, these dependent claims depend from independent claim 1 and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim additional unobvious combinations including: the first and second inert gases are the same gas; vacuum reflow soldering

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comprises heating around an integrated circuit package on a printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum; or moving an integrated circuit package on a printed circuit board in at least one direction of horizontally, vertically, and a combination thereof from replacing the air, removing the first inert gas, reflow soldering, providing the second inert gas, through replacing the second inert gas.

Regarding claims 7-8 and 10, these dependent claims depend from independent claim 6 and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim additional unobvious combinations including: vacuum reflow soldering provides the integrated circuit package on the printed circuit board having solder bumps with 90% of the solder bumps formed having less than 10% empty voids and 10% of the solder bumps having less than 20% empty voids as a percentage of volume; vacuum reflow soldering comprises heating around the integrated circuit package on the printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum; or moving the integrated circuit package on the printed circuit board in at least one direction of horizontal, vertical, and a combination thereof.

Based on all of the above, it is respectfully submitted that claims 1-3, 5-8 and 10 are allowable under 35 U.S.C. §102(b) as not being anticipated by Schmatz because:

“If the reference fails to teach or suggest even one limitation of the claimed invention, then the claim is not anticipated.” *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750 F.2d 1569, 1574, 224 U.S.P.Q. 409, 411 (Fed. Cir. 1984).

Claims 1-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Mitten et al. (US 2003/0160088 A1, hereinafter “Mitten”).

Mitten discloses a vacuum heat treating furnace for brazing a large metallic part. A workpiece handling system is mounted on the pressure vessel door for supporting a metallic workpiece to be heat treated or brazed. The workpiece handling system includes apparatus for

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rotating the workpiece during a processing cycle. A vacuum system is connectable to the workpiece for creating a subatmospheric pressure inside the workpiece during a brazing cycle.

Regarding independent claims 1, 6, 11, and 16, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified in claim 1, includes the limitations not disclosed in Mitten of:

"replacing air around an unsoldered part with a first inert gas;
removing the first inert gas to form a vacuum around the unsoldered part;"

The Examiner states in the Office Action:

"Mitten teaches...means for replacing air around an unsoldered part with inert gas, means for replacing the gas with vacuum, means for backfilling the vacuum with gas and air which can be used for cooling (paragraphs 23-25 and 29)..." [deletions for clarity]

Applicants respectfully disagree. It is respectfully submitted that Mitten paragraphs 23-25 and 29 do not disclose the claimed elements but instead discloses heating, vacuum, gas-injection, and forced gas cooling systems performing different functions:

[0023] The vacuum brazing furnace according to this invention also has a heating system. ... Heating of the workpiece in the hot zone is accomplished by direct radiation on the parts, by quiescent convection heating, and, when desired, by conduction heating through an inert gas atmosphere. ...

[0024] A process gas injection system is also provided for introducing an inert gas into the pressure vessel...

[0025] The heating, vacuum, gas-injection, and forced gas cooling systems are controlled by a programmable logic controller (PLC). ...

[0029] A furnace cooling system 70 is provided to cool the pressure vessel 12...."

Mitten paragraphs 55 and 56 disclose the functions performed by the Mitten elements described in paragraphs 23-25 above are to form a vacuum in the furnace, fill the furnace with inert gas, form a vacuum in the workpiece, fill the workpiece with inert gas, form a vacuum in the workpiece, and braze in the inert gas:

[0055] A typical sequence for operating the vacuum brazing furnace of this invention will now be described. ...The sealed pressure vessel 12 is then evacuated by the first vacuum pumping system 40. When the desired vacuum is reached, the pressure vessel 12 is backfilled with argon gas. The pressure vessel 12 is then evacuated again.

[0056] A vacuum is then drawn on the interior of the workpiece using the

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second vacuum pumping system 60. ... Argon gas is backfilled into the interior cavities of the workpiece, and then a second vacuum is drawn in the workpiece interior. ... Simultaneously, the vessel chamber is pressurized by the heating of the inert gas with occasional injection of additional argon gas as necessary. The temperature and pressure are continuously increased until the desired temperature and pressure conditions for brazing the workpiece W are reached. ..."

Based on all of the above, it is respectfully submitted that independent claims 1, 6, 11, and 16 are allowable under 35 U.S.C. §102(e) as not being anticipated by Mitten because:

"Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*" [emphasis added] Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co. (730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984)(citing Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 220 USPQ 193 (Fed Dir. 1983)))

Regarding claims 2-5, these dependent claims depend from independent claim 1 and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim additional unobvious combinations including: the first and second inert gases are the same gas; vacuum reflow soldering comprises heating around an integrated circuit package on a printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum; removing the first inert gas includes simultaneously heating an integrated circuit package on a printed circuit board having solder paste printed thereon at a plurality of different temperatures and replacing the second inert gas includes simultaneously cooling the integrated circuit package on the printed circuit board having solder thereon at a plurality of different temperatures; or moving an integrated circuit package on a printed circuit board in at least one direction of horizontally, vertically, and a combination thereof from replacing the air, removing the first inert gas, reflow soldering, providing the second inert gas, through replacing the second inert gas.

With regard to claim 7 and 17, these dependent claims depend from independent claims 6 and 16, respectively and are believed to be allowable since they contain all the limitations set forth in the independent claims from which they depend and claim additional unobvious combinations including: vacuum reflow soldering provides the integrated circuit package on the printed circuit board having solder bumps with 90% of the solder bumps

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formed having less than 10% empty voids and 10% of the solder bumps having less than 20% empty voids as a percentage of volume; or the reflow unit provides the integrated circuit package on the printed circuit board having solder bumps with 90% of the solder bumps formed having less than 10% empty voids and 10% of the solder bumps having less than 20% empty voids as a percentage of volume.

Further, the Examiner states in the Office Action:

"Mitten teaches... As the soldering is performed in a vacuum, the apparatus is capable of forming solder bumps with very low void volumes. Although the reference teaches soldering of a circuit board, it is noted that the object soldered does not further limit the apparatus."

Applicants respectfully disagree. The Mitten brazing is performed in an inert gas as indicated in Mitten paragraph 56:

"[0056] ... Simultaneously, the vessel chamber is pressurized by the heating of the inert gas with occasional injection of additional argon gas as necessary. The temperature and pressure are continuously increased until the desired temperature and pressure conditions for brazing the workpiece W are reached. The preferred temperature and pressure will depend on the size of the workpiece and the type of material or materials that are being brazed. The workpiece is maintained at the brazing temperature and pressure for a time sufficient to ensure thorough heating of the workpiece."

Regarding claims 8-10, these dependent claims depend from independent claim 6 and are believed to be allowable since they contain all the limitations set forth in the independent claim from which they depend and claim additional unobvious combinations including: vacuum reflow soldering comprises heating around an integrated circuit package on a printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum; or removing the first inert gas includes simultaneously heating the integrated circuit package on the printed circuit board having solder paste printed thereon at a plurality of different temperatures and replacing the second inert gas includes simultaneously cooling the integrated circuit package on the printed circuit board having solder thereon at a plurality of different temperatures in the unloading unit after moving the integrated circuit package on the printed circuit board in the first move; or moving the integrated circuit package on the printed circuit board in at least one direction of horizontal, vertical, and a combination thereof.

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Based on all of the above, it is respectfully submitted that claims 1-10 and 17 are allowable under 35 U.S.C. §102(b) as not being anticipated by Mitten because of Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., *supra*.

Regarding claims 11-12, 14-16, and 18-19, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified in claim 11, includes the limitations not disclosed in Mitten of:

"a loading lock for replacing air with a first inert gas and for removing the first inert gas to form a vacuum around the integrated circuit package on the printed circuit board, the loading lock for filling the vacuum with air, the first inert gas, or a second inert gas after removing the integrated circuit package on the printed circuit board;
an unloading lock for providing the second inert gas to fill the vacuum and for replacing the second inert gas with air around the integrated circuit package on the printed circuit board, the unloading lock for filling the vacuum with air, the first inert gas, or the second inert gas after removing the integrated circuit package on the printed circuit board."

The Examiner states in the Office Action:

"Mitten teaches a system [with]... loading locks (doors 21,22)"
[insertion and deletion for clarity]

It is respectfully submitted that a fundamental principle contained in 35 U.S.C. 112, second paragraph is that applicants are their own lexicographers and the terms loading and unloading locks are defined in Specification page 7, line 4, and page 8, line 1, respectively. Thus, the Mitten doors 21 and 22 would not anticipate the claimed locks.

Regarding claims 15, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified in claim 15, includes the limitations not disclosed in Mitten of:

"a conveyor system for moving the part among the loading lock, the reflow unit, and the unloading lock."

Mitten has a table that does not move the part among a loading lock, a reflow unit, and a unloading lock.

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Regarding claim 20, this dependent claim depends from independent claim 16 and is believed to be allowable since it contains all the limitations set forth in the independent claim from which it depends and claims additional unobvious combinations including: a conveyor system for moving in horizontal, vertical, and a combination thereof the integrated circuit package on the printed circuit board.

Based on all of the above, it is respectfully submitted that claims 1-20 are allowable under 35 U.S.C. 102(e) as not being anticipated by Mitten because:

“A claim is anticipated only if each and every element *as set forth in the claim* is found, either expressly or inherently described, in a single prior art reference. (Kalman v Kimberley Clark Corp., 713 Fed. 2nd 760, 771, 218 USPQ 781, 789 (Fed. Circ. 1983), *Cert. Denied*, 465 U.S. 1026, 224 USPQ 520, 1984.)” [emphasis in original]

Other

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Panitz et al. (US 5,409,543, hereinafter “Panitz”), Tanaka et al. (US 5,454,507, hereinafter “Tanaka”), Cottone et al. (US 5,102,032, hereinafter “Cottone”), and Chugai (JPN 53-123354-A, hereinafter “Chugai”).

Conclusion

In view of the above, it is submitted that the claims are in condition for allowance and reconsideration of the rejections is respectfully requested. Allowance of claims 1-20 at an early date is solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this

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paper, including any extension of time fees, to Deposit Account No. 50-0374 and please credit any excess fees to such deposit account.

Respectfully submitted,



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